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Graphical user interface design for NTCSSAM: shipboard administrative requirements

Graves, Thomas C.

Monterey, California. Naval Postgraduate School

NAVAL POSTGRADUATE SCHOOL
Monterey, California

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THESIS

GRAPHICAL USER INTERFACE DESIGN FOR NTCSSAM: SHIPBOARD ADMINISTRATIVE REQUIREMENTS

by

Thomas C. Graves

March 1995

Thesis Advisor: C. Thomas Wu
Co-Advisor: David A. Gaitros

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13. ABSTRACT *(Maximum 200 words)*

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We review and analyze QFD and the Mayhew design methodologies and select the QFD tools and Mayhew phases to improve NTCSSAM. In addition to this, a survey form is used to compile user inputs to document improvements to NTCSSAM. To improve NTCSSAM we construct a prototype that includes functionalities necessary to create an enlisted evaluation. This prototype represents a subset of the functionalities of NTCSSAM. The prototype includes the functionality to enter crew members, enter command information, and edit text for creating enlisted evaluations.

The methodology and design tools improved documentation by including all design inputs on matrices making them accessible to users, programers, and developers. It reduced the amount of time required to design and program functionalities for NTCSSAM by three weeks. The survey form produced a comprehensive list of functionalities and provided valuable user input about improving NTCSSAM. Using these methods to create a prototype for NTCSSAM improved the prototype's graphical user interface of the prototype by including user inputs.

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GRAPHICAL USER INTERFACE DESIGN FOR NTCSSAM: SHIPBOARD ADMINISTRATIVE REQUIREMENTS

Thomas C. Graves
Lieutenant, United States Navy
B.S., United States Naval Academy, 1987

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Author: [redacted]

Thomas C. Graves

Approved by: [redacted]

C. Thomas Wu, Thesis Advisor

[redacted]

David A. Gaitros, Co-Advisor

[redacted]

Ted Lewis, Chairman
Department of Computer Science

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I. INTRODUCTION

The purpose of this thesis is to evaluate which methodologies to use for designing constructing and an administrative program for U.S Navy surface ships. Naval Tactical Command Support System Administrative Module (NTCSSAM) is a administrative shipboard program that is under development at NAVMASSO and intended to reduce the administrative burdens found on naval ships. This research will review design methods and the design tools that can be used in order to construct NTCSSAM. As an example of one of the design tools, a survey will be conducted of fleet personnel where they will indicate their preferences regarding various aspects of shipboard administrative management. The last section of the research will explain the development of an Enlisted Evaluation Program that prints evaluation reports for United States Navy enlisted personnel.

The possible methodologies that could be used in the development of NTCSSAM will be analyzed and how these methodologies improve design. The importance of analyzing these design methods is to demonstrate how these methods can improve the required functionalities, improve the interface, and maintain an acceptable cost level of NTCSSAM to accomplish administrative tasks. This research reveals that using these proven methodologies and their tools of development on a project, such as NTCSSAM,+ can significantly improved the final project. These design tools allow the users and designers to establish the scope of the functionalities, improve documentation, and reduce the amount of time spent redesigning a product when conflicts arise in the design process.

NTCSSAM is designed to completely consolidate and automate all shipboard administrative requirements and significantly reduce the manual administrative work load of fleet personnel. The initial design phases of NTCSSAM is critical to a successful and functional product to reduce the fleets administrative burden. As a result, a review of several design methods and their benefits will be provided that could improve the initial development of NTCSSAM. In addition to the methodologies of design a interview will be conducted. This interview is intended to solicit user preferences and desired functionality

to be included in NTCSSAM. As an example of the type of functionality that can be included in NTCSSAM, a prototype for an Enlisted Evaluation program will be developed. This program will also incorporate several of the design methodologies recommended for the design of NTCSSAM.

A. BACKGROUND

The amount of time shipboard personnel devote to the organization and dissemination of administrative information consumes an average 56 man hours per week updating training records alone [Ref. 1]. Reducing this time through automation would enable personnel to spend more time with other duties. Shipboard Naval Automated Data Processing (SNAP) system is the current shipboard automated system intended to assist in the administrative duties onboard naval ships. SNAP attempted to alleviate the burden of these administrative duties and was successful in several ways but not complete.

The need for automating all the administrative facets of shipboard management and its advantages has been written about for many years. These needs center around saving time and manpower and are discussed in detail in [Ref. 1] and [Ref. 2]. Functional improvements to SNAP have been researched and several are described in [Ref. 1]. NTCSSAM is intended to automate all faces of shipboard administrative requirements and be a networked administrative manager that performs all the functional requirements needed in shipboard administration. NTCSSAM will also interact with or contain the functionality of the programs listed in Figure 1 on page 3.

NTCSSAM is designed to combine all these administrative requirements under one system to provide administrative documentation for shipboard inspections as well as the frequent administrative reporting to off ship type commanders, supply departments, and personnel requirements. Incorporating all the functions and data included in Figure 1 on page 3 and other shipboard administrative requirements under NTCSSAM will reduce the redundancy of data and the amount of time personnel spend collecting information, maintaining records, preparing reports, and disseminating information to various channels.

B. OBJECTIVES

This research will cover three different aspects related to NTCSSAM. The first aspect will be to prioritize the areas of administrative requirements listed on the survey form in Figure 2 on page 7. This prioritizing will represent the top four areas that the

Source Data System (SDS)
Uniform Military Disbursing System (UMIDS)
Source Data System (SDS)
Real-Time automated Personnel Identification System (RAPIDS)
Naval Aviation Logistics Command Information System (NALCOMIS)
Total Force Manpower Management System (TFMMS)
SNAP Automated Medical System (SAMS)
Dental/Medical Information System (DENMIS)
Enlisted Distribution and Verification Report (EDVR)
Maintenance Resource Management System (MRMS)
Onboard Proficiently Maintenance Integration System (OPMIS)

Figure 1: Proposed Functions/Data to be Included in NTCSSAM

interviewed users would like to see automated in NTCSSAM. In addition users will indicate any specific functional description that they would like to see included in NTCSSAM. Second, aspects of several design methodologies will be reviewed to assist in organizing the functionalities required by the user. These design methods are the kind of design techniques that can to used in the development of NTCSSAM. These advanced design methodologies are recommended to establish a compatible interaciton between users, designers, and developers. These tools or methods of design enhances the documentation of a project and several have been proven highly successful in modern commercial industry.

These methods of design enhance the relationship between users, designers, and engineers ensuring the highest quality product and can be used on projects of varying size.

The final area of research involves the development of a smaller project using several of the design methods that will be discussed. This Thesis will introduce a working prototype of a Windows based Enlisted Evaluation Program that can be implemented into NTCSSAM. This includes basic design requirements, user input, development of a prototype, and user inputs about the prototype. This will provide specific information regarding a human factors analysis, what users like about the screens and functionality, of a Windows based Enlisted Evaluation Program. The software interface design of the Enlisted Evaluation Program is presented as an example of a project that has the potential to reduce the administrative requirements for naval personnel and how it can be emulated directly by the Navy and the administrative functions to be incorporated in NTCSSAM. Using the Enlisted Evaluation Program as an example, the documented user preferences can be incorporated into a networked Windows based prototype for NTCSSAM.

C. INTERFACE DESIGN REQUIREMENTS

The presentation of data is one of the most important considerations when developing a system that manipulates information and data into the desired formats to be displayed, reviewed, or printed. Shipboard Naval Automated Data Processing (SNAP) features a layered menu approach where information can be found by selecting from one choice on a screen cascading down to the layer that will display your information. To exit retracing your path is sometimes the only way to return to the main menu. A detailed discussion of the drawbacks and benefits of this system are presented in [Ref. 1] but it required more time and effort for the user who often had to memorize the path to find the functional screen they were looking for. Today the industry standard of windows based applications is so dominant that attempting to emulate any other style of interface would increase the initial time required to learn an application unnecessarily. One hundred percent of all interviews conducted with the survey form found in Figure 2 on page 7 indicated a familiarity with windows based applications and the use of pull down menus, further

supporting the use of the Windows standard. The development of NTCSSAM interface requirements is best represented following the standards set forth in a Windows based applications and is required to follow the standards as described in[Ref. 3], the government standards for emulating Windows environments.

D. DESIGNING A GRAPHICAL USER INTERFACE

Developing a graphical user interface consists of numerous facets but most of these relate to cost, ease of use, and functionality. It is not a simple task to require a product to perform exactly to the specifications, reduce the cost while making the product so intuitive and easy to use little or no training is required. In order to achieve these goals or even come remotely close, there is a path or course of action that must be taken to ensure that the desired results of minimal costs, ease of use and a fully functional product are achieved[Ref. 4]. The specific guidelines of constructing a product may depend on its size and use, but many corporations are not inventing new methods of how to approach design rather they are seeking the expertise of others or using a method proven in other corporations that have used a specific design method to improve or make a new product better [Ref. 5].

In the design of a graphical user interface there is always a trade off between cost, ease of use, and functionality. User interface design is a matter of compromise for powerful functionality with a simple clear interface. Users demand ease of use and ease of learning always at a minimal cost. When you design a interface conflicts between funtionality, ease of use, and cost always arise. These conflicts between designers, manufactures, and consumers are better solved when the use of some type of structured method or technique is used to assist in organizing and making the necessary trade-offs that inevitably arise. Not finding these conflicts before a certain stage and certainly before coding begins will result in one of the three facets mentioned above not meeting with the standards expected by the consumer. A structured method of design promotes good design discussions for a specific product and its users and allows for a well documented product.

NTCSSAM is no different than any other product when it comes to the philosophy of design and a quality product for it users. NTCSSAM should be developed following a method or technique that has been used and proven in commercial industry to ensure it will meet the basic facets of design mentioned above. Choosing a specific method and justifying it is not a simple

task. Because of this, a detailed comparison of design methods will not be given. Rather a review of some of the techniques is better served. Of the several design methods reviewed;

- Design methods by Mayhew
- Developing user interfaces by Hartson and Hix
- QFD by Bob King

QFD offers the most detailed and documented method that is most suitable for the dynamic personnel structure in the Navy. This documentation is supported through the use of several tools for obtaining, organizing, and coordinating information that must be applied to the design of a project. The effectiveness of QFD or managing information has also been demonstrated by several corporations including users form major U.S. and Japanese corporations [Ref. 6]. In addition to QFD the methodology of Mayhew provides a good structure for the overall design of a product dividing the project into five phases of design where specific tasks are divided among various organizations.

E. OUTLINE

This research presents major topics at each chapter. The major focus of this thesis is centered around three areas. The first is to present different types of design methodologies and the tools they use to improve the design and development of NTCSS. The second, reviews the needs of the users through a survey form found in Figure 2 on page 7 and include a list of desired functionality from the users from this survey as depicted in Figure 3 on page 8. The last aspect of this thesis will discuss the construction of an Enlisted Evaluation Program whose functionality can be incorporated into NTCSS. A prototype of this Enlisted Evaluation Program is developed to illustrate the functionality desired by users and illustrate the enlisted evaluation program and its development using the tools of the design methods discussed.

Automating Navy Administrative Requirements

Date:_____

Name:_____

Positions held:_____

The goal of this survey is to improve the functionality of SNAP by having the users critique the functionality of the system.

The use of current technology can improve SNAP so that it will manage all shipboard administrative data and produce required reports without all the traditional work. To this end, it is imperative to have the user define what a system is to do. Envision any repetitive reports that your chain of command wanted that left you scrambling through service records or old SNAP files. If all this information were available from a workstation, report writing would be much simpler.

Listed below are areas of SNAP that could benefit by improving their functionality. **Rank the 4 areas where you think improvement is most required. List any functional tasks that you would like to see changed or included**. An example of a functional task is; "I would like to be able to print out a 13 week graph of someone's PQS progress for their PQS tasking".

Maint	Tickler	Custom Query system	Watch Bill
Berthing	Lifeboat	Training/PQS/Schools	Dep/Div
Personnel (evals /edvr/lortarp)		Career Counselor/Advancement	Visitor control

TASKS

1._____

2._____

3._____

4._____

3. Are you familiar with Windows based applications i.e. the use of pull down menus and toolbars?

(circle one) yes no

4. What types of software programs have you used that were designed to manage administrative functions. What did you like most or dislike most about these programs.?

5. Please give any other comments about administrative management.

Figure 2: Survey Form for NTCSSAM

Department division

professional development boards
training exercises and selex completion and tracking
departmental tickler, project planner
material history logs

Training and PQS

who's prd is within six months
list crew not qualified in given pqs like general dc
track pqs for individual school
start date, estimated completion date,% complete
create 13 week tracking for crew individual
track proficiency watches necessary for maintaining qualification
list nec's and crew on board that fill them filter by division and department
pqs qualifiers list
schools
list who needs to go based on watches
list who is leaving in 6 months and recommend a replacement
availability list
schools scheduled with prospective crew members for attendance
support for gmt, departments divisional training
yearly, quarterly, monthly and if required
weekly training plan

Watch Bill

create a fire fighting and import watch bill that don't conflict
create under way watch bill by checking against PQS
enter crew into watch bill then have query fill remaining slots
change section of person
enter new qualifications and schools
print crew member with qualifications and schools
list people by section with watch standing
who has been to FF team trainer and what% of the team did it together

Figure 3: Desired Functionality For NTCSSAM

Division Officer notebook/ personnel

- advancement eligibility
  - what requirements need to be met pars, courses, leadership exam
- list where every one lives by compartment and list rack number
- who is eligible for mess duty
- prospective gain and losses
- generate messages for various requirements like prospective gain and losses
- recall bill
- ships bills

Supply

- List all jobs with casrep parts and their status
  - lis by work center, department, all or JSN
- Write CASREP message

Lifeboat

- Life boat alpha list
- lifeboat muster list
- lifeboat

Visitor control

- access security list
- automatic addition and deletion to master list on quarter deck
- list by name or organization

Berthing

- list all empty racks
- list racks in a compartment with who is in them which are empty
- query name and indicate rack number

Career counselor

- Advancement eligibility
  - muster list, order exams

Ships office

- mailing labels
- social roster

Desired Functionality For NTCSSAM Continued

II. NTCSSAM FUNCTIONAL DEVELOPMANT

Naval Tactical Command Support System (NTCSSAM) is the next phase in the development of a total shipboard automated management tool that includes maintenance, supply and administrative requirements for ship and soar Naval personnel. NTCSSAM is the new name of the system that is currently called SNAP, Shipboard Naval Automated Data Processing system, and whose most recent version is called SNAP III. The first steps being take in the development of NTCSSAM is to review and automate the Administrative module of SNAP and include more advanced functionality into NTCSSAM. NTCSSAM administrative module is designed to reduce and automate the manual administrative work load both ashore and afloat. In addition to the improvements to the graphical user interface and functionality of SNAP, improvements will be made in updating software and hardware and bringing them more in-line with today's standards. The Hardware and software concerns will not be discussed instead a concentration on improving the functionality of NTCSSAM and using an advanced design tool or methodology for construction NTCSSAM will be discussed

A. DESIGN METHOD

User interface design is an exercise in documentation and the coordination of the users desires. It involves trade-offs between powerful functionality and a simple and intuitive common sense interface. An interface should be easy to use and learn and have a consistent design across the interface. In addition to this performance, cost must be factored into design to meet the requirements of the consumer. Because these requirements conflict with each other and are present throughout the entire design of a product a method or technique is required to guide and help effectively manage the design of the user interface and the functionality it will posses. A good method or technique will assist in making good design decisions ensuring all aspects of design are meticulously compared and reviewed. The types of design methods that will be discussed all emphasize a structure and consistency in each method. Each recommends that tasks for a design method be carried

out in a particular order at certain points over the entire life-cycle of the design project and software development while recognizing some may be conducted in parallel.

The design methods that are describe are a representation of the type of structure that can be used in the construction of a new product or upgrading a product using an interface design tool or method. These methods are complex and require extensive discussion for their implementation. The description of these methods is to give the reader some idea of the style and structure that is used and not a detailed analysis of its implementation. The details of these design methods can be found in the references for each respective one.

1. Mayhew Design

The design method describe by Deborah Mayhew consists of five phases listed in Figure 4. The life-cycle depicted by Mayhew is divided up into tasks delineated to specific

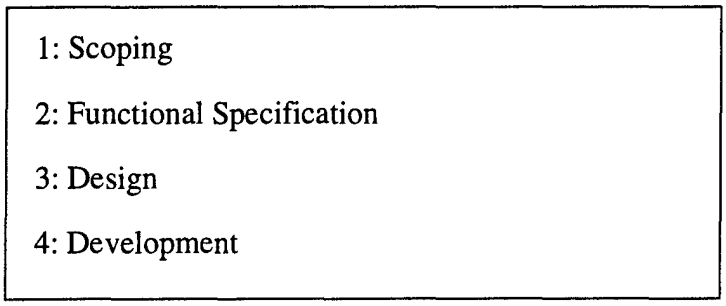

Figure 4: Mayhew Phases of Design

departments within an organization. All tasks (that is, not just user interface tasks) in a typical system development life cycle are presented in the order that they would be carried out, according to the responsible organization [Ref. 4]. Mayhew's phases are best described with a graphical representation where interface tasks, project team responsibility, and interface tasks are listed as shown in Figure 5 on page 13. This figure is the graphical representation of the second phase of Mayhew's design, the Functional Specification phase. User interface tasks are written in shaded boxes on the graph. The clear or white

boxes represent actions required of the project team. Moving from left to right represents the relative time for each event. The layout of the phases in a specific order gives the impression that tasks are completed in a distinct order with the beginning of one relying on the completion of another. This is not always the case. Several of the tasks can overlap and can be conducted at the same time. For one thing, the different groups will have their own tasks to be working on. Referring back to Figure 5, the project team can be working on the functional specification task while the user interface group can be working on the task analysis. However, the user interface group must complete task analysis before beginning with user interface goal setting.

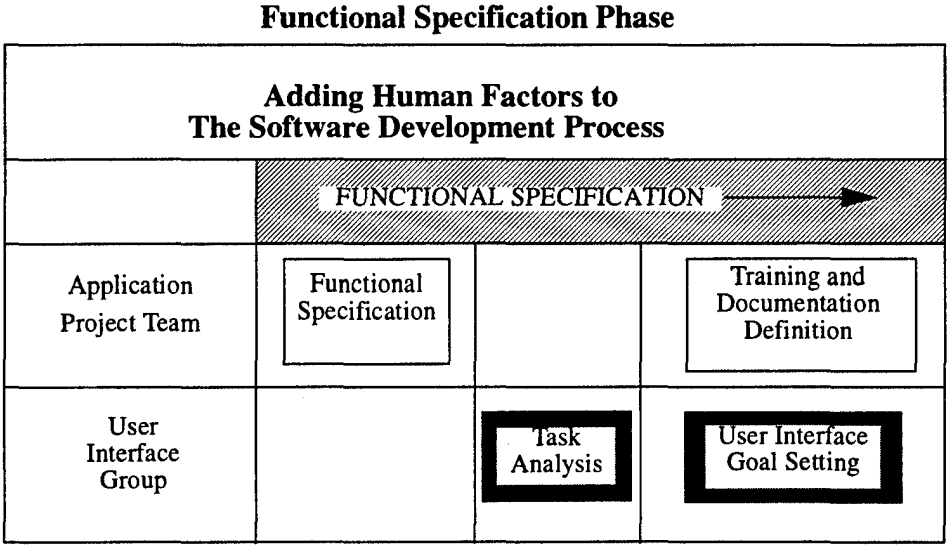

Figure 5: Mayhew's Functional Phase from [Ref. 4]

2. QFD

Quality Function Deployment (QFD) is a design technique for integrating customer requirements into product design. QFD was introduced into the United States by Yoji Akao

in October of 1983 in the journal of the American Society of Quality Control. Since then major corporations such as General Electric and Ford Motor Corporation have used QFD to better implement consumer demands and bridge the gap between manufacturing and design using this method of development. QFD has proven to be excellent at integration new technology, managing and organizing the functionality of products and their cost. The main goal of QFD is to expand the time it takes to define the product but shorten the time it takes to make changes or redesign the product after construction. The result is intended to eliminate extensive redesign that costs more and takes more time than the time spent on the initial design phase. This design process can be represented by the drawing found in Figure 6. The defining of the product takes longer but the time saved in redesign results in

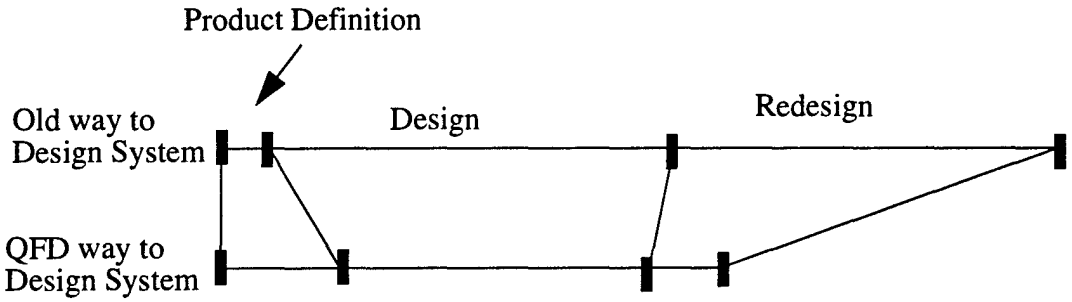

Figure 6: Old Design Method and QFD Design System from [Ref. 5]

a net reduction in total product design. The time savings from using QFD can be one third to as much as one half the time that it would take using conventional methods [Ref. 5]. QFD

can be organized into four phases of planing where the seven tools of QFD are utilized to enhance the process. Using the seven tools of QFD, a quality matrix is constructed. It is this matrix of QFD which maintains the detailed documentation and acts as the support to bridge the gaps between design and manufacturing ensuing a quality product for the user and preventing extensive redesign.

a. Four Phases of QFD

QFD is a design process that centers on the needs of the consumer or user. It is designed to focus on these needs and translate them into technical specifications and ultimately a product. The QFD process usually occurs in four phases as depicted in Figure 7. The first phase of QFD is "Customer Demands" or "Voice of the Consumer." This

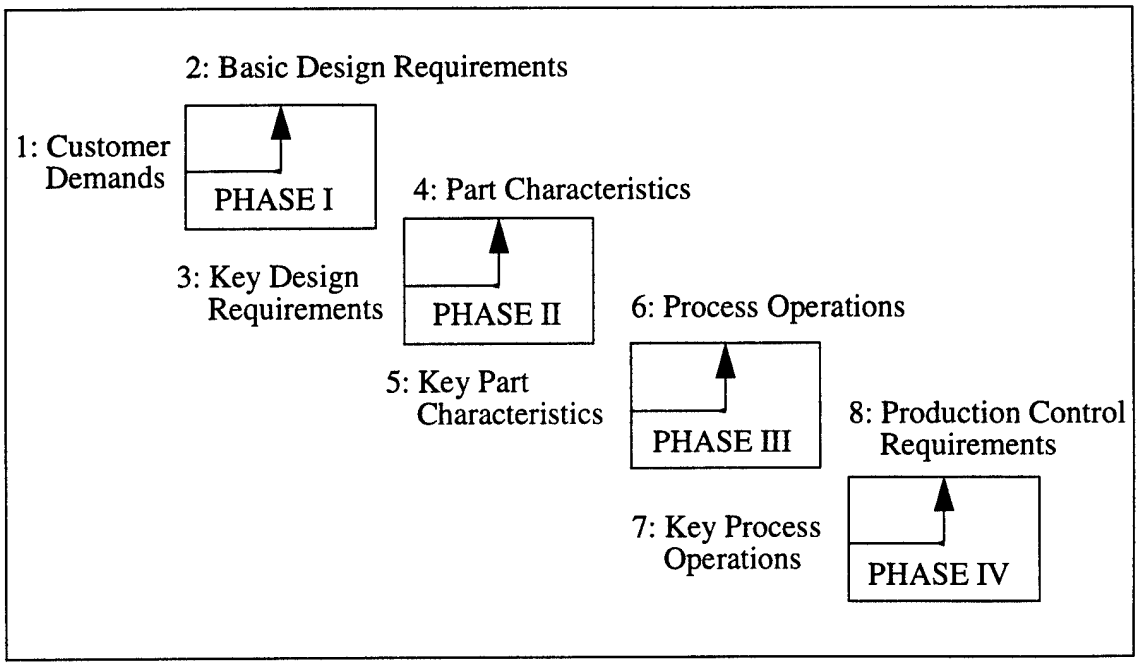

Figure 7: Four Phases of QFD from [Ref. 6]

represents the desires of the consumer or user and what they would like the product to do. This involves finding both the requirements the user knows about and the latent demands

of the user before any other step is taken. The users demands or requirements involves the design team having frequent discussions with current and potential users of the system. Determining the needs of the user are extremely necessary but are no means adequate in determining the scope of the products functionality. Integrating senior management and policy makers to determine the direction in which requirements are heading and if any new requirements will be required that current users are not aware of must be integrated into the products functionality. Phases II through Phase IV of the QFD Cycle rely heavily on the information gathered in Phase I. The remaining phases relate to parts, manufacturing, and the control requirements of manufacturing. In Phase II the key technical characteristics are translated into part characteristics. In Phase III of the QFD cycle, the key part characteristics are linked to key manufacturing operations. And in Phase IV the key manufacturing operations are assigned specific control requirements to insure reliability and consistent quality [Ref. 7].

b. Seven Tools of QFD

There are seven planning tools that are used during the four phases of QFD. The tools are listed in Figure 8 on page 17 with a brief description of each. All of the tools are used for organizing and planning information necessary for design. These tools are different than other tools used in development because they are simple to understand and use [Ref. 5]. Because they are so simple more people and organizations want to use them.

c. QFD Matrix Charts

QFD is designed to support up to thirty matrices to organize the data that is collected throughout the design process. The purpose of these matrices is to allow designers and manufactures to work from the same set of requirements and information while developing each product. Each one of the matrices compare two elements of design and graphically represent the relationship one has with the other. Two such areas may be customer demands and quality characteristics. As an example we will discuss the first matrices that is normally developed and what tools are used to create the matrices. The first

step after collecting information from the consumer or user is to group his desires using an affinity diagram (also called a KJ Diagram). The affinity diagram organizes the users ideas into groups that will be placed into a column in the matrix. From each of the elements in the Affinity Diagram a list of Quality Elements must be listed for each one. These two elements, the demands of the consumer and the quality elements, are then entered into a matrices. The user inputs are located along the left hand side of the matrix and the quality elements are placed on the top of the matrix. This not only lists all the demands of the user but allows the comparison of these desire to be evaluated with regard to a quality element.

1: Affinity Diagram - organizes customer demands

2: Interrelationship Diagram- which ideas influence another idea

3: Tree Diagram - Identifies ideas in greater and greater detail

4: Matrix Chart - Compares ideas for correlations

5: Matrix Data Analysis Chart - What markets to enter

6: Process Decision Program Chart - Lists what can go wrong

7: Arrow Diagram - Shows aspects that can be completed simultaneously

Figure 8: Seven Tools of QFD

B. QFD AND A SPECIFIC DESIGN METHOD

The development of NTCSSAM will include communicating fleet and type commanders requirements to analysts and programmers that adequately describe the desired functionality of the new system. In addition to the requirements set forth at these

levels fleet personnel, or users, will evaluate the graphical interfaces for NTCSSAM while they are being developed to ensure that the implementation of all functionalities is included and the quality of the end product meets the expectations of the users in the fleet. To act as a nucleus of users NAVMASSO has created a Fleet Design Team from senior enlisted personnel from various commands and warfare specialties to act as the embodiment of the users in the fleet that will use NTCSSAM. This Fleet Design team will rely on their own expertise of SNAP and provide the necessary inputs to analysts and programmers to ensure a quality product is developed.

1. Initial Development

The process of developing an interface with the desired functionality can seem rather simple. The Fleet Design Team interviews the fleet and describes what administrative requirements the fleet desires to designers. Programmers and designers then convey with each other and construct the program. After the construction of the program the Fleet Design Team evaluates the product for its ease of use and functionality ensuring it meets the specifications they desire. Are expert uses the best choice for a team of interviewers? Expert users may know the system but are not trained to interview people and may not necessarily know the technology that can influence the way questions should be asked [Ref. 5]. For example, does the fleet design team know how to derive the latent needs of the user from an interview? Does the Fleet Design Team know the spectrum of users that require being interviewed? Are the survey forms and interview techniques consistent so conflicts in functionality can easily be resolved. All these questions should be reviewed in detail before customers or fleet members are interviewed to obtain information. There must be a methodology to translate customer needs into a product and organize multiple departments of designers and engineers to efficiently accomplish this.

2. Improving NTCSSAM Though Design

The design methods listed above have been proven in the commercial world. They show that a structured design not only improves the product but reduces the amount of time

to produce it and minimizes the redesign process. NTCSSAM can benefit from these methods in several ways. Using trained interviewers, as recommended in [Ref. 4], one can better determine the users requirements while determining if the users have any latent needs which are not conveyed by the user. Some of the latent requirements of the user may be solved by the new technologies to be implemented in NTCSSAM. These technologies are familiar to trained interviewers where expert users of SNAP or the Fleet Design Team would not. A structured design method will also provide NTCSSAM with a more organized means of documentation. Several fleet personnel interviewed indicated sending messages concerning the improved functionality to SNAP II over a year ago [Ref. 8]. These inputs could have been consolidated and used in a survey form today and disseminated to fleet personnel, most of the administrative needs then are still the same today. In addition to fleet input, inspection teams have requirements that they are developing that can be included as functional tasks. These functionalities are still pertinent even though users are unaware of these additions today. Obtaining this type of information is discussed in [Ref. 6] where interviewing senior personnel and developmental personnel in an organization can reveal other functionalities not found form the users requests.

C. NTCSSAM SURVEY FORM

Surveys are one of the most common and intuitive tools to solicit large audiences for information regarding their demands for a system they wish developed. Surveys can be used to compile information or to compare various products to determine a certain level of quality. Surveys are a good way to collect information but they have their limitations like anything else. Users will not tell you everything about a product or have a limited view of possibilities for a product based on their limited exposure or knowledge of technological improvements. Revealing the customers needs or opinions is the purpose for generating a survey. The survey generated for NTCSSAM is intended to consolidate the customers need rather than their opinion of a product.

1. Customer Needs

Customer demands can be divided into three areas; what customers expect but not tell you about, what they tell you they want and what they need but have not considered. This division of needs has been researched by Professor Kano in Japan where he developed a chart, Figure 9, to display these characteristics. The top arrow represents "exciting

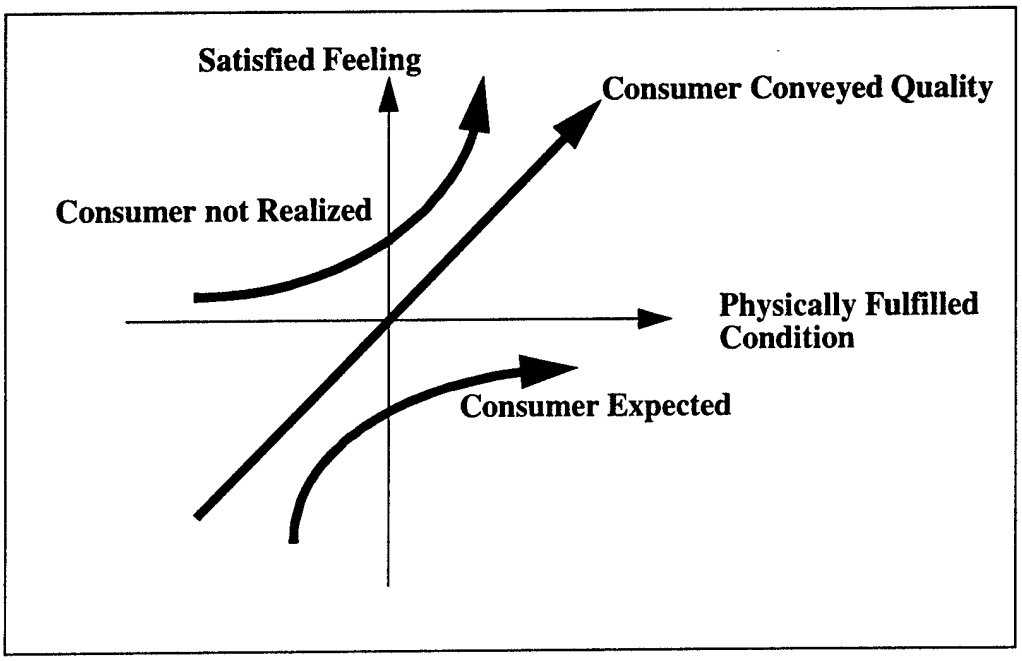

Figure 9: Customer Needs from [Ref. 9]

quality" that producers and developers know the users need or will end up using in the future. The middle arrow represents "one-dimensional quality" where customers tell you what they want. The bottom arrow represents items that are expected. The expected aspects or functions are less likely, if at all, to be conveyed by the consumer to the survey or interviewer.

2. Survey Form Results

The survey form that is shown in Figure 2 on page 5 is intended to provide NAVMASSO with user inputs regarding desired functionalities to be included into NTCSSAM. Users were also asked to prioritize areas that they would like to see improved by listing the top four areas they would like to see worked on and improved to become part of NTCSSAM. The survey revealed the four top areas in the order of highest priority first as;

- Training and PQS
- Watch Bill
- Dept/Div
- Maintenance

Each of these were listed more than any of the others with Training and PQS receiving a higher priority than the Watch Bill. All of the surveys indicated each user being familiar with windows based applications. Several PC based software programs were being used in the fleet to assist in administrative management including TAMP for PQS and Training. Users also revealed they are familiar with a DOS based evaluation program but did not indicate the name and contended it was not user friendly. Most of the comments about administrative management indicated a disbelief that a SNAP based system could fulfill the needs of the fleet and recommended third party products that could be used on a networked group of PC's. Users also listed a number of functionalities that is included in Figure 3 on page 9.

III. CONSOLIDATED LIST OF RELATED RESEARCH

A. THESIS RESEARCH ON TRAINING

There are two theses that have researched the area of training for improving and upgrading SNAP. The first simply describes what the training requirements are for ship board personnel as placed on them by Type commanders in their respective fleets [Ref. 2]. [Ref. 2] can give the reader a consolidated report on the various requirements and what the reports for these requirements look like without reading the large volumes published by the Navy regarding this subject. The most recent research has been done by Conrad Chun and William Estrada in their 1992 Thesis "SNAP-III Training Administrative Subsystem Integrated Functional Description" [Ref. 1]. This thesis provides a functional description for a shipboard training administrative subsystem following the U.S. Navy Standard Organization and Regulations Manual. This thesis list the requirements and enhancements necessary to achieve a working administrative training module.

B. ARGOS

Argos is a system designed to facilitate the reduction of paperwork onboard Naval Ships. The attractive part of ARGOS is its use of a user friendly graphical user interface created with the software HyperCard on an Apple Macintosh. ARGOS has a tightly linked graphical user interface with an underlying data structure. ARGOS is being developed in several modules that can be combined and used for administrative requirements on Naval Ships. One of the major goals of ARGOS is to reduce the amount of time required to learn a system and make it easier to use.

C. WINOMMS

Winomms is another graphical user interface designed to manage maintenance requirements on Naval Ships. This is a Windows based application created using Asymmetric's Toolbook. Toolbook is designed to allow rapid prototyping of display screens to create graphical interfaces. The creation of Winomms was designed to lay on top

of the current data structures found in SNAP and be the interface users interact with to obtain data and produce reports.

IV. ENLISTED EVALUATION PROGRAM OVERVIEW

A. ENVIRONMENT OF EVALUATION PROGRAM

1. Evaluation Program

The Enlisted Evaluation Program is a Microsoft Windows application developed with Microsoft's relational database software Access. Access conforms to the government requirements for software design listed in [Ref. 3] and is ideally suited for developing rapid prototypes. This rapid prototype tool is made to develope graphical user interfaces and combine this graphical interface with an underlying relational database.

2. Evaluation Program Environment

The users environment that is found in the Enlisted Evaluation Program is consistent with Microsoft Windows based applications. This was selected for several reason. This environment is required for government applications and it is an accepted industry standard. This standard, because of its graphical orientation, is easy to navigate through. Tool bars and menu bars allow the access of any task with only a few mouse command. Icons are used where appropriate to represent certain tasks or applications. These types of graphical tools allows the user to easily navigate without remembering numerous command line codes and typing them into a computer to access or manipulate information.

3. Development Software: ACCESS

Access is a Microsoft Windows application used for the development of applications that require a relational database to store and retrieve information. Access 's relational database supports the industry standard of a windows environment and incorporates sequel queries to retrieve information from its underlying data structure. It is a powerful relational database which allows the developer to create a working computer model, a rapid prototype, through the use of pre-defined commands and a application device called the "Wizard."

The development of a rapid prototype using Access allows for the creation of a windows based application that will emulate the look and feel of other windows based applications. Access, or any application developed with Access, can be launched from within a windows environment using a pull down menu or an icon that represents that application.

B. APPLICATION OF EVALUATION PROGRAM

1. Purpose of the Enlisted Evaluation Program

The Enlisted Evaluation Program was developed to provide a user friendly graphical user interface for producing U.S. Navy enlisted evaluations. The graphical interface incorporated as part of the Enlisted Evaluation Program is intended to reduce the amount of time required for training personnel to use the program and create evaluations. For those users who are experienced user this Enlisted Evaluation Program reduces errors in data entry by using pull-down menus for selecting input items and field formatting for data that requires entry by hand. The program also enables the use of one set of data for multiple evaluation thereby reducing repetitive data entry. The details of formatting and the use of pull-down menus will be covered in the application design phase.

2. Problems with Current Programs

Evaluations for enlisted personnel are usually produced using a DOS based application. These applications create files for each personnel that required an evaluation and all the information for each individual must be typed in. When creating numerous evaluations that all have information that is exactly the same this information must be typed into every evaluation. For example, Each evaluation has a block labelled "Command Address." This information is the same for every evaluation in a command and using the DOS based programs today require this information must be typed into each evaluation. A relational database has the compatibility to allow the user to select the "Command Address" from a list, requiring no typing other than the initial one, and copy that entry into

the evaluation. Repetitive typing is a major draw back that can be resolved by selecting information from a list instead of typing it in every where it is needed in the evaluation. The written text that must be included in the comments section must be typed in using a word processor and imported into the file for each individual evaluation. This text can not be viewed in the DOS application for editing. Any editing must be done outside the program and then imported again into the DOS application. This involves the opening and closing of applications for each evaluation being typed. This Enlisted Evaluation Program does not require this constant exiting and entering but allows for the editing to occur inside the program using the editor of your choice.

3. Why use the Enlisted Evaluation Program

The Enlisted Evaluation Program is more appealing to users for several reasons. The program has a set of display screens that are intuitive to use making the program easy to learn and use. These screens are set in a Windows environment, familiar to most every one that uses a personnel computer. Data that is input into the program is stored in a relational database and can be recalled for use bye queries and subsequently used in any evaluation for any personnel. this allows selections to be made from pull down menus with the click of a mouse rather than typing in repetitive data.

V. ENLISTED EVALUATION PROGRAM DESIGN

The Enlisted Evaluation Program is designed following the phases set forth in Debora Mayhew's book Principles and Guidelines in Software User Interface Design, [Ref. 4]. The phases of Scoping, Functional Specification, Design will all be addressed regarding the construction of the Enlisted Evaluation Program. The last two of the five phases; Development and Testing/Implementation have not been completed and are left for later research. Limiting the number of phases allows for a more manageable scope of the project to be completed and does not detract from the idea that a good interface design methodology in necessary for developing a quality product. In addition to the phases of Debora Mayhew several of the QFD tools will be used in gathering and organizing information for completing several of the phases in this research.

A. SCOPING PHASE

The Scoping of the Enlisted Evaluation Program involves planning the project, conducting a user profile and defining the hardware and software requirements. Usually a business definition and a business requirements analysis is conducted to begin the decision to develop a new product. These two documents begin the formatting of the idea to be developed. The need is first established and digitalis about these needs are gathered from marketing or users and the project plan begins to form

1. Project Plan

The project plan for the Enlisted Evaluation Program is not complicated or extensive. The development of the program is rooted in the need for a shipboard Windows evaluation program that would reduce the time and effort to create a new evaluation. A requirement analysis of several users that have experience with existing software revealed a dissatisfaction with the current interface and the functionalities of the programs in use. Staffing and cost of the project must also be considered and in the case of the Enlisted

Evaluation Program the staffing is one and the cost was the price of obtaining the developmental software, Access by Microsoft Windows.

2. User Profile

The users of the Enlisted Evaluation Program will be both enlisted and officers. These individuals are relatively computer literate, motivated, and experienced at their job. Generally the officers of a command complete all the details of the evaluation and a yeoman would check for format and fill out the summary blocks for each evaluation prior to having the reporting senior sign each of the evaluations. All of the users interviewed indicated a familiarity with Windows based applications and all of the users have a familiarity with personnel computers and the use of word processing software used on computers. Emulating the Windows environment and using familiar word processing software will reduce the time required to adequately learn the program. All the users indicated a familiarity with evaluations and the data entry fields on the forms. This familiarity is used to ease the learning of the programs data entry by matching the entry names on the computer screen to the names on the evaluations. Both ease of use and ease of learning will be stressed in the development of the screens of the Enlisted Evaluation Program.

3. Hardware and Software Definition

a. Hardware Requirements

The Enlisted Evaluation requires an IBM PC compatible computer that has the features listed in Figure 10 on page 31. This is the minimum requirement for a respectable performance, any additional hardware such as a faster CPU, more RAM or faster hard drive will improve performance of your program.

b. Software Requirements

The software requirements are listed in Figure 11. The software that is used for word processing can very but must conform with Object Linking and Embedding

Version 2.0 (OLE 2.0). This linking standard allows a text document of the word processor to be stored and viewed in the database. While it is stored in the database entering and exiting the application is not required to view the document.

1: 386, 486 CPU / 33MHZ

2: 40 Megabyte Hard Drive

3: 4 Megabytes Ram

Figure 10: Hardware Requirements

1: Microsoft Windows 3.X

2: Microsoft Access 2.0

3: Microsoft Word 3.5 (any word processor with OLE 2.0)

Figure 11: Software Requirements

B. FUNCTIONAL SPECIFICATION PHASE

This phase focuses on Task Analysis, User Interface Goal Setting, and Training and Documentation Definition. The Task analysis was conducted with surveys of the users to consolidate their desires. The Task analysis also involved interviews of several users to reveal any latent requirements that users did not realize today's technology offered them. Specifics on User Interface Goal Setting and Training and Documentation Definition were not analyzed.

1. Task Analysis

The Task Analysis for the Enlisted Evaluation Program was conducted using interviews and the survey form. The input given by the users was organized into an Affinity diagram where the users inputs could be correlated into technical characteristics. The first interview process revealed the required functionality of the Enlisted Evaluation Program. This list produced the foundation of characteristics that the program will have.

a. Required Functionality

The functionality of any evaluation program must enable the user to print out a enlisted evaluation in the proper format with all its copies to be submitted as a final evaluation into a service record. The functionalities included in this program were compiled from user inputs as well as its designer. Although there are not many in the list in Figure 12 on page 33 implementing these in a graphical user interface is not a trivial matter. All of the required functionalities were included. Each of the functionalities listed is a written statement or sentence to better convey its meaning.

b. User's Functional Inputs of Prototype

The user functional inputs of the prototype involve a designer showing the Enlisted Evaluation Program to several users for inputs on how it likes the navigational features, radio buttons, pull-down menus and other interface features that effect functionality. All of the subjects in this study were Naval officers with fleet experience. After reviewing the prototype the users requested the following inputs found in Figure 13 on page 35

1: Enter ships divisions

2: Enter ships reporting senior including full name, rank, title, SSN.

3: Enter ship or station address.

4: Enter and edit crew information including full name, rate, date of rate, last report date, ratings, branch or class, date reported, status, SSN.

5: Create evaluations that print the form of a standard enlisted evaluation.

6: Select or create more than one evaluation for a crew member and be able to enter or change period of report to, period of report from, type of report, occasion for report, advancement recommendation, reserve part, date signed, physical readiness, and all grades for the required categories.

7: Enter text for duties and comments section of the evaluation with the capability to underline and bold face type any character.

8: Enter numbers for summary information for each grade on the evaluation form.

9: Print and preview drafts and final copies of the evaluations including the OCR, bupers, field, member, and activity copy in the fonts required bye the Navy.

Figure 12: Functional Requirements

C. DESIGN PHASE

The design phase involves the following user interface design methods mentioned bellow;

- User Interface Mock-up
- Style guide
- Detailed user Interface Design
- User interface Prototyping
- Prototype User Interface test plan
- Prototype User Interface Testing

These methods of Deborah Mayhew are discussed in detail in [Ref. 4]. The first area of this phase involved a user interface mock up of the system. This involved the development of a rapid prototype using the developmental software Access By Microsoft. This prototype was constructed using the government style guide in [Ref. 3]. The User Interface Mock-up was modified to create a Detailed user Interface Design which was later used in the Prototype user interface testing phase.

1. User Interface Mock-up

This mock-up is based on the user profile, the hardware and software definition, the task analysis and organized in to the primary display screens the user would navigate through. The Style Guide method is incorporated into this phase as well and described in detail in [Ref. 3]. The style guide for the program was produced by the government and is required to be followed for developing windows based applications. The use of the rapid prototype software Access, allowed the User Interface Mock-up to be completed relatively quickly. The interface mock-up produced the look and feel of the screens but the screens do not have the data manipulation features of the relational database added in. These features are added in the detailed use interface design phase. These screens are described and shown in detail in the next section.

2. Detailed User Interface Design

This phase incorporates the screens, user input formats, error messages, and complete working functionality. Again, these screens and functionalities must adhere to the style guide discussed earlier. All the screens in the Enlisted Evaluation Program contain

1: When moving from front to back of evaluation have the individual you were working on be immediately displayed so you do not need to select him from the group.

2: Create a button that will make all the grades for an individual Not Observed.

3: Be no more than three mouse clicks away from any screen.

4: Be able to use it with any word processing software.

5: Support importing text files and have the capability to use bold face text and underline characters.

6: Use proper fonts required by Navy: OCR A and Courier. Be able to easily change these for new requirements.

7: Have security so division officers can not see the file of someone who is not in their division.

8: print multiple evaluations based on a division, rate, or period of report to date.

Figure 13: User Inputs

tool-bars and pull-down menus. The pull-down menus are design to maneuver from one screen to another with the fewest mouse movements The tool bars are designed to perform frequently used tasks for each of the screens. The program incorporates several screens that are linked together for creating an evaluation for an enlisted person. The screens are design so shared data can be used by everyone using the program. Enlisted evaluations contain two

types of information. Information common to all crew members and information specific for a certain crew member. A ships reporting senior and his pertinent information is data that will be found in every evaluation and be identical. The name, rank, and social security number of one reporting senior can be found on hundreds of evaluations and does not need to be typed for each evaluation. A certain crew members social security number is specific for that crew member. Information about the ship, its reporting seniors and evaluation summaries will usually be entered by Yeoman in the commands office. Data specific to a crew member such as their write up in the comments section and specific evaluation grades will be entered by the division officer or whoever is tasked to write the evaluation. All the necessary information necessary to produce an evaluation is provided for in the program and presented on the screens.

a. Pull Down Menu Selections

Before discussing the screens a description of the pull-down menu should be given. This menu is common to all the screens with very few exceptions. It was used so users could easily navigate to any part of the program by simply pulling down the menu and selecting the area they desire to go. The pull-down menu found in Figure 14 on page 37 is representative of the menus found in all the screens.

b. Password Screen

The password screen is shown in Figure 15 on page 38. This screen is the first screen to be displayed when the ICON for the Enlisted Evaluation Program is double clicked with a mouse. This screen will determine whether the individual logging on will acquire access to the program. An individual must type in their name and password which

is verified with the internal listing of the same. If the password is found is granted and the main screen is displayed.

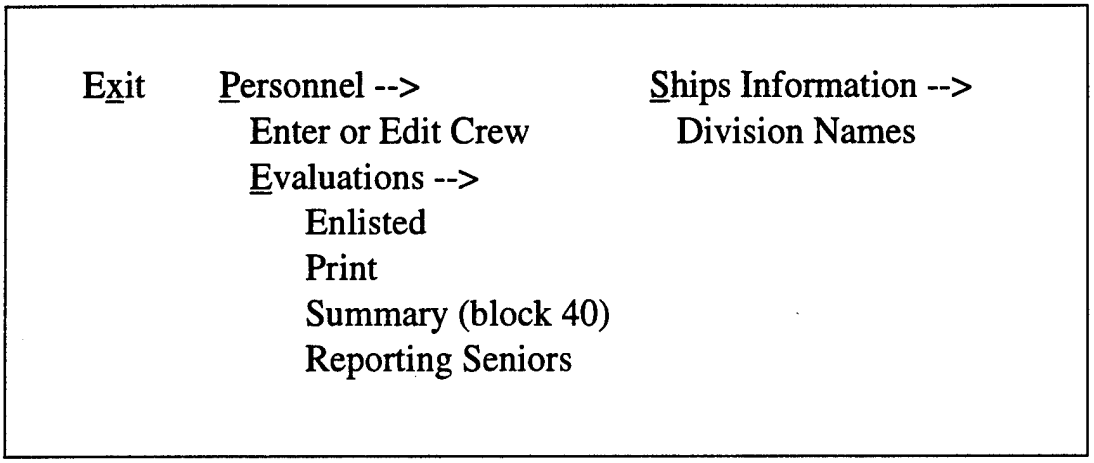

Figure 14: Pull-Down Menu Screen

c. Main Screen

The main screen is shown in Figure 16 on page 39 and opens after successfully logging on to the program. As displayed in the figure the user has several choices; editing or creating a new evaluation, enter or edit crew member, or print evaluations. The same commands are found in the pull-down menu but beginners who used the program expressed desires to have those choices prevalent when they first entered the system.

d. Reporting Seniors Screen

The reporting seniors screen is usually filled out by the commands yeoman or a designated administrative worker. This screen lists all the senior officers in the command that are eligible to be the final signature authority on enlisted evaluations. Reporting seniors can be added or edited from this screen and includes all of the pertinent information about each reporting senior that can be found on an enlisted evaluation. The reporting seniors screen also contains the ship or station address which will be entered on all evaluations. The Reporting seniors screen is presented in Figure 17 on page 41.

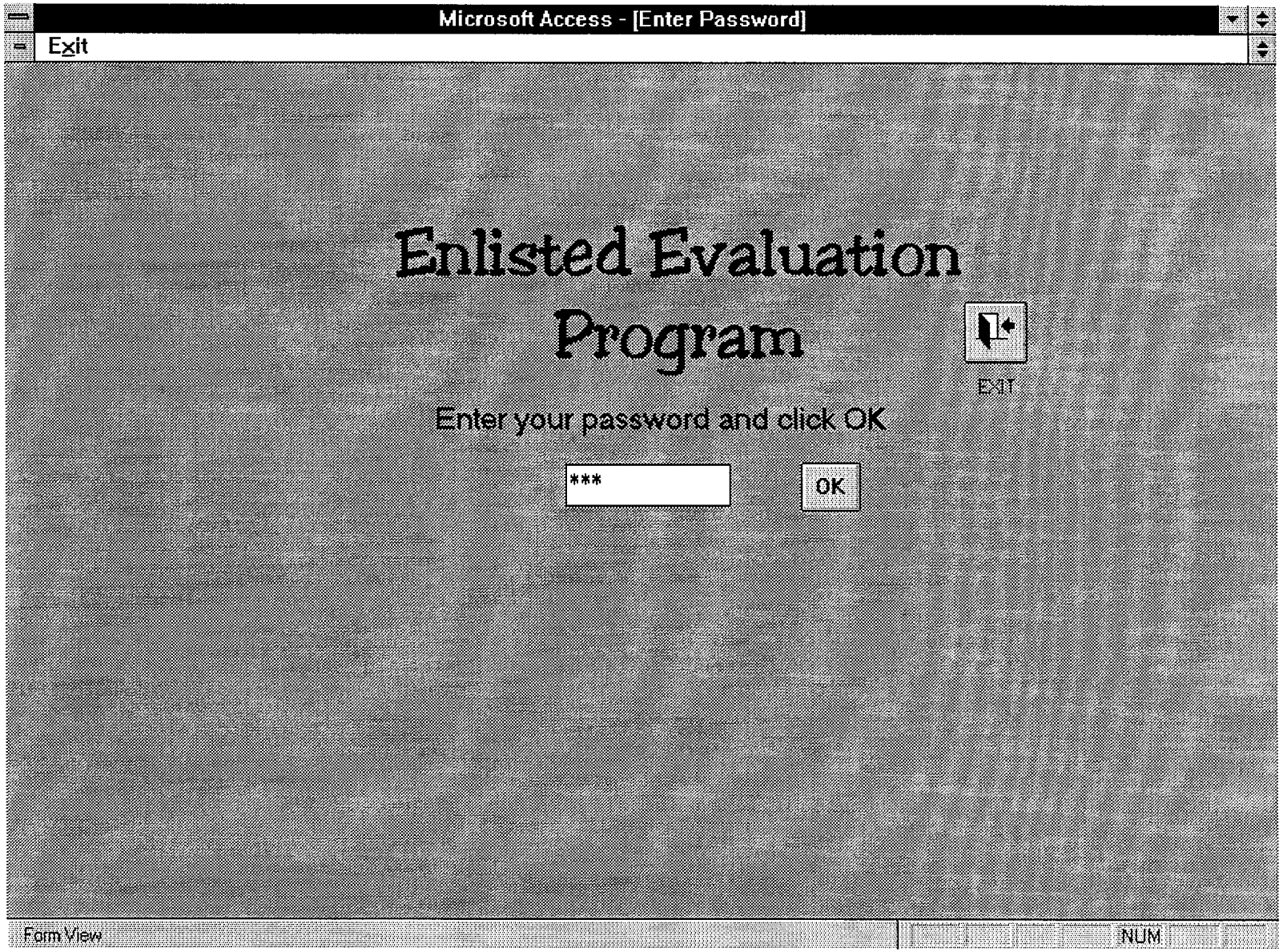

Figure 15: Password Screen

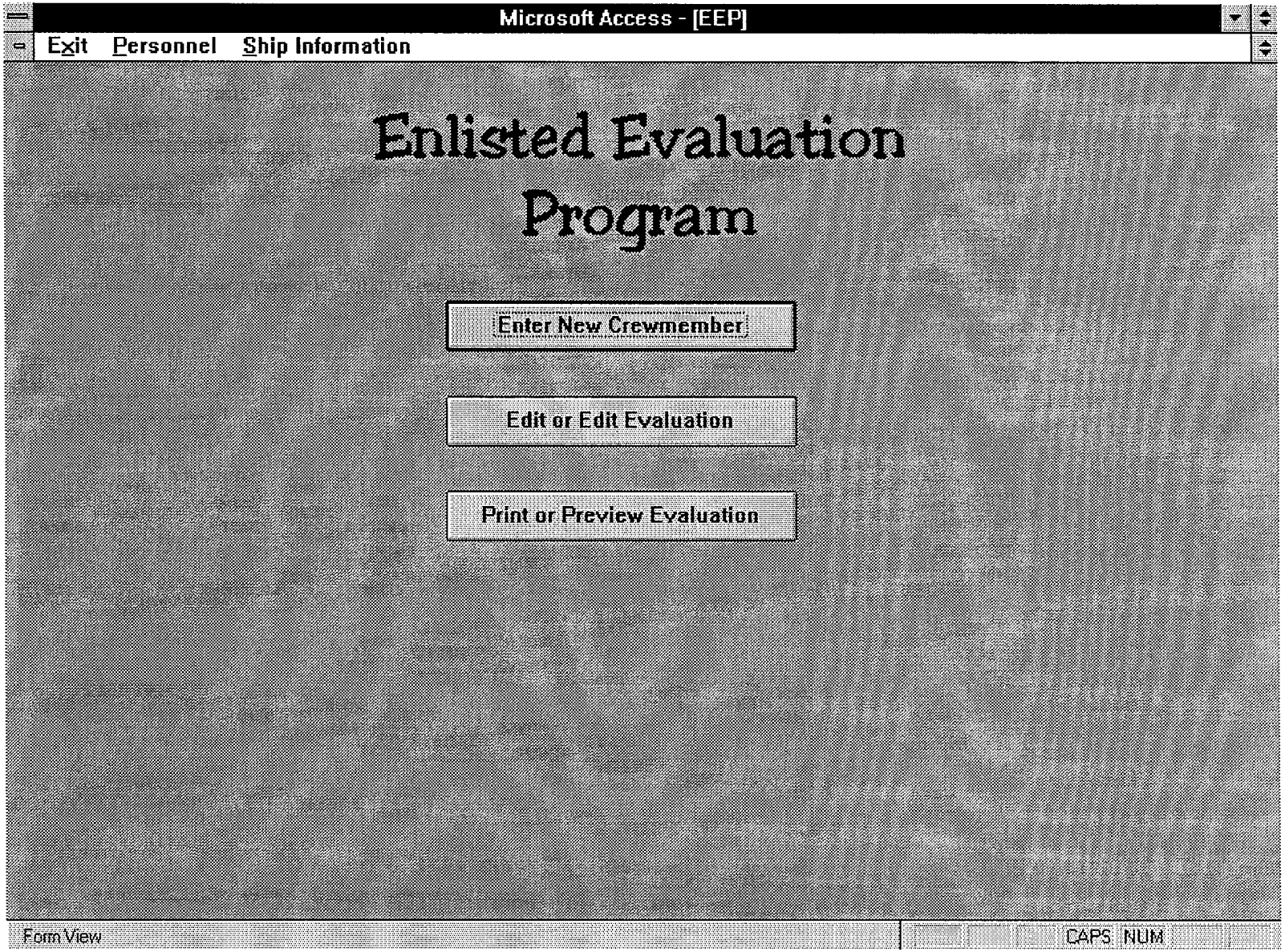

Figure 16: Main Screen

e. Evaluation Summary Screen

All enlisted evaluations contain summary boxes that list the number of servicemen and women that have been ranked under a certain grade. This screen allows you to select the group of individuals by rank that you desire to enter summary information for. After selecting the rank or pay-grade, the final date of the evaluation and the number of servicemen and women can be entered for each grade in an evaluation. The Evaluation Summary Screen in Figure 18 on page 43 shows group E-7 and above and will allow you to enter or change the "period of report to date" and type in the number of personnel that are marked under each grade. The "period of report to date" is the end date of the evaluation. This screen will normally be filled out after all evaluations are turned in for final signature so a yeoman or administrative assistant will manipulate this screen.

f. Crew Entry or Edit Screen

The crew entry or edit screen prompts the user to select a division and crew member to edit or select the new record button to enter a new crew member into the database. New crew member can not be added to the database unless there is a minimum set of information to store. The program will not store a table that does not contain information in it. An individual must have a social security number, be part of a division, and have a reporting senior in order to be stored in the database. This information is required because the sequel queries that manipulate data require this specific data to be in place so the program can sort the information in the database. Several of the selections have pull-down menus associated with their specific data entry. These menus give the user a finite list of data to choose from that is required for that specific data block for a specific crew member. Requiring a simple selection to input text can eliminate typographical errors for that specific block and it can also eliminate erroneous entries. Some of the entry fields, like the "Date Of Rate" fields are limited in length to seven characters and require a certain format that must be printed on to an evaluation for it to be acceptable. The format for all date entries permit only seven characters to be entered. The order and type of characters entered begin with the last two numbers of the year followed by the first three letters of the

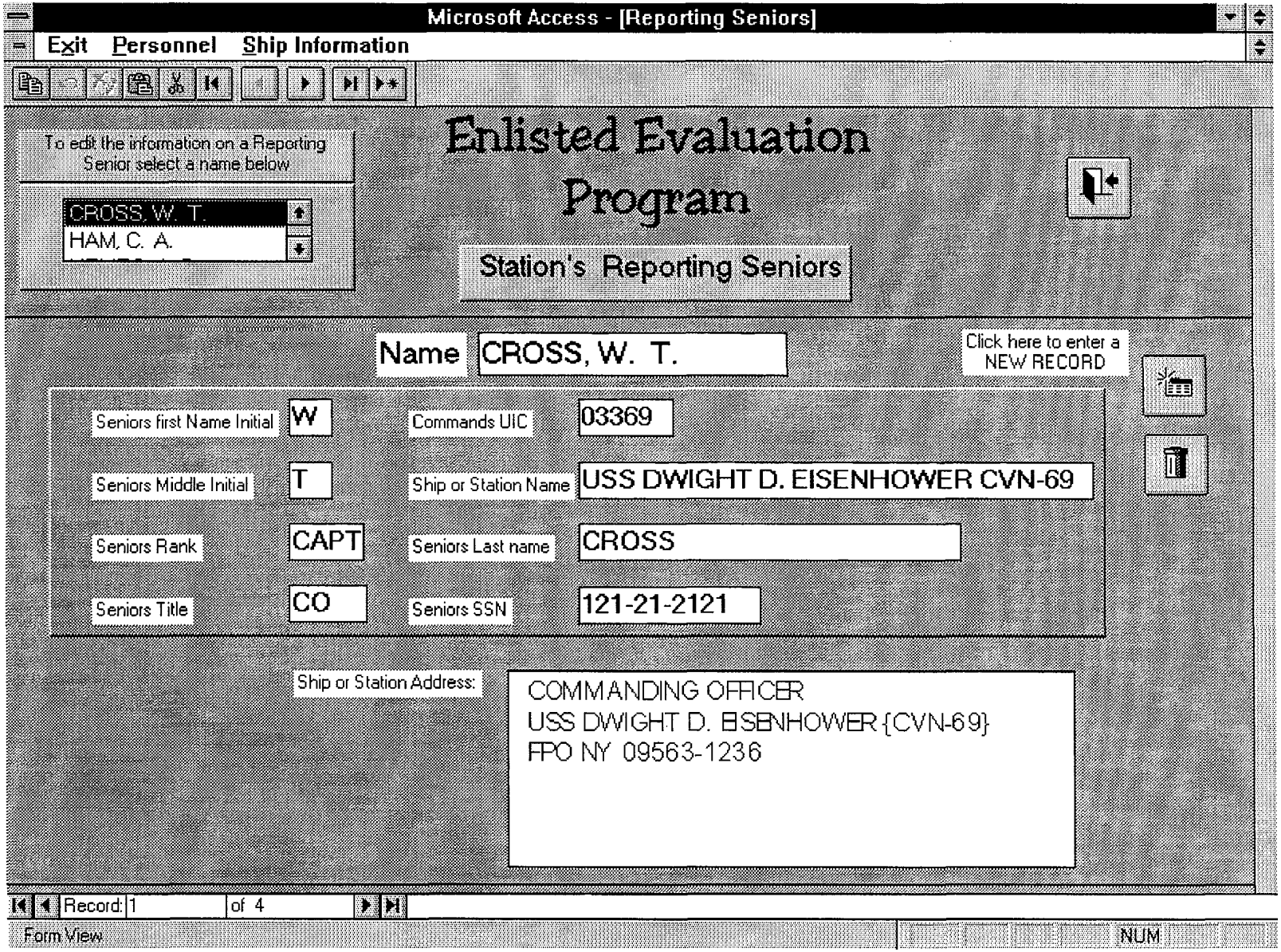

Figure 17: Reporting Seniors Screen

month then the day of the year. This format will resemble this; 95MAR23. The characters that make up the month part in the date field are all automatically capitalized by the Enlisted Evaluation Program. The Enlisted Evaluation Program limits the users data entry, in the case of a date field, to these requirements. Other fields such as Ratings represent a pull-down menu with a finite number of selections. There are only enlisted ratings from E-1 to E-9 and those are the only selections a user can select from the pull down menu and have accepted in this data field. If a user tries to type data in that does not match one of these built in formats it will not be accepted by the program. This entry form is displayed in Figure 19 on page 44.

g. Front of Evaluation Screen

The front of the evaluation screens provides for pull down menus to enter data that has a finite number of inputs. Again the user can select an exiting crew member from the menus then determine whether to create a new evaluation or modify and existing evaluation for the crew member he has selected. The rating and division selection boxes generate queries to limit the names the user selects from to limit the amount of crew members displayed. This will prevent users from having to search through all the names in the crew just to find the crew member the user is looking for. Evaluations for the same crew member are sorted by crew name and date allowing multiple evaluations for each crew member. Pull-down menus are also utilized to limit the data entry selections on the front of the evaluation page. This screen is the first in the program to use radio buttons to reduce the amount of data entry. Radio buttons are used in order to complete multiple entries with just one command by filling in all the grading categories with "not observed" or four point zero grades. Although the menu bar at the top allows navigation between all screens this form also has command buttons that will move you to one of the next logical screens after editing the front of the evaluation. From this screen you are likely to edit the back or print out an evaluation, these buttons are located at the top of the screen in Figure 20 on page 46

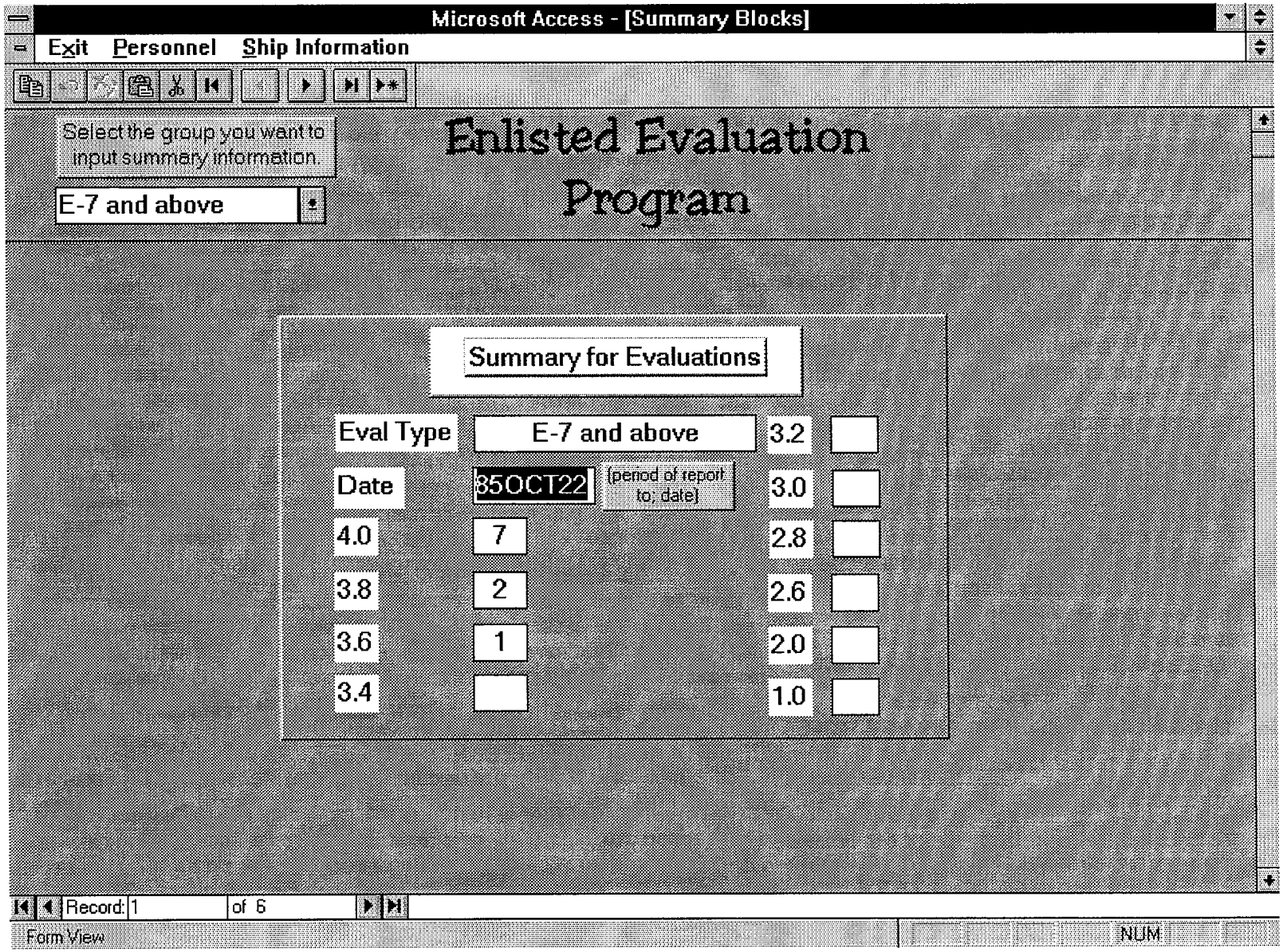

Figure 18: Evaluation Summary Screen

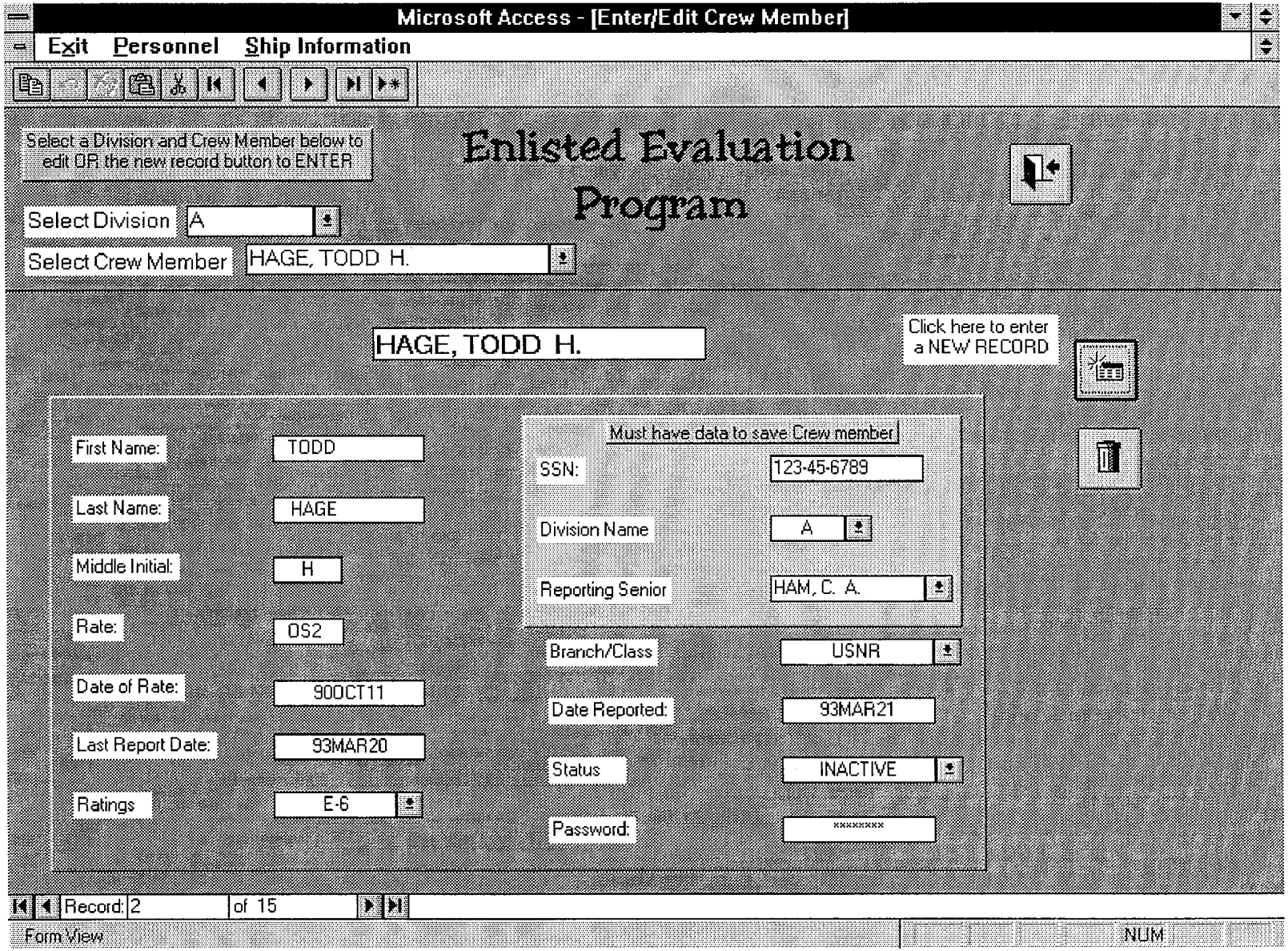

Figure 19: Crew Entry or Edit Screen

h. Back of Evaluation Screen

The back of the evaluation was the most difficult to emulate. This screen involves incorporating a text editor and storing this text in the relational database. Again users can select the division and name of the personnel they desire to edit and the evaluation date for that specific crew member. Instructions at the top of the editing space instruct you to click you mouse in one of the boxes, either duties or comments box, and follow the commands to insert an object. The object that will be stored in the relational database is a text file created with a word processor. You will then be prompted to choose the type of object you wish to insert by choosing from a list of word processing software you have stored on your computer. The software that will be displayed in the box not only must be on your computer but it must support OLE 2.0. After selecting the software you will use, like Microsoft Word, that specific application is launched inside of the Enlisted Evaluation Program and is displayed in the box you clicked with your mouse. The back of the evaluation screen with the word processor being used is shown in Figure 21 on page 47. From here you enter the text in the proper format that will be printed on the back of the evaluation form. To exit you word processing software you click with your mouse on any object on the button labeled editing complete and continue with another task.

i. Print Screen

The print screen for evaluations was created with the same format as the others. Selecting the crew member to be displayed is done in the same way with division and rating. Following this the user can select the crew member and evaluation date to be printed. The users can either print or preview the front or back of the enlisted evaluations. The radio buttons that are labeled Evaluation Copies Front and Back are used to print out final copies of the evaluation. These buttons will print four copies of the evaluations final version. This will include the bupers, filed, activity, and members copy and the OCR copy of the front or back part of the evaluation. The top radio buttons labeled Evaluation Front and Back only print out one copy to allow revisions to be edited by hand before the final copies are printed.The print evaluations screen is depicted in Figure 22 on page 48.

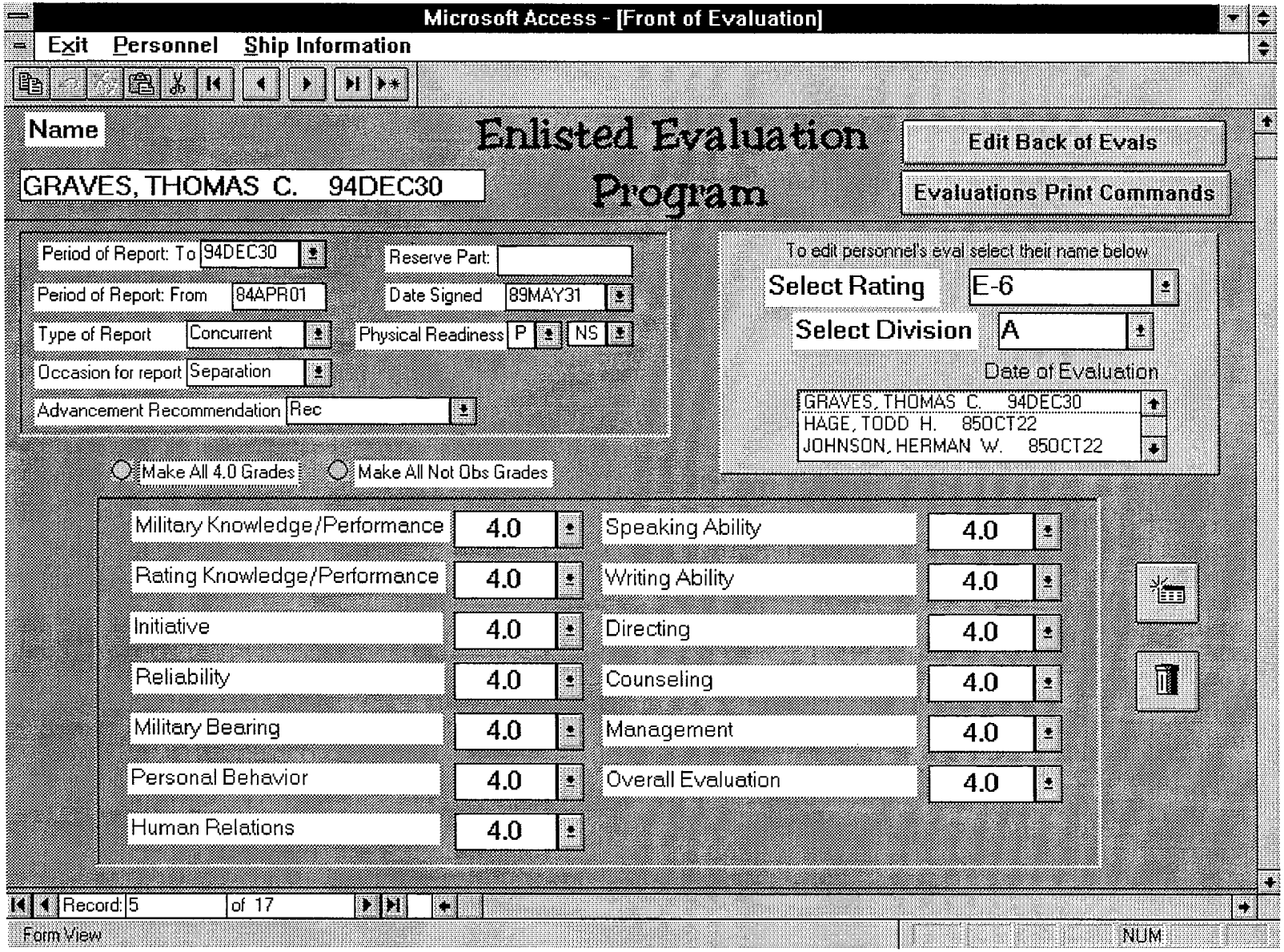

Figure 20: Front of Evaluation Screen

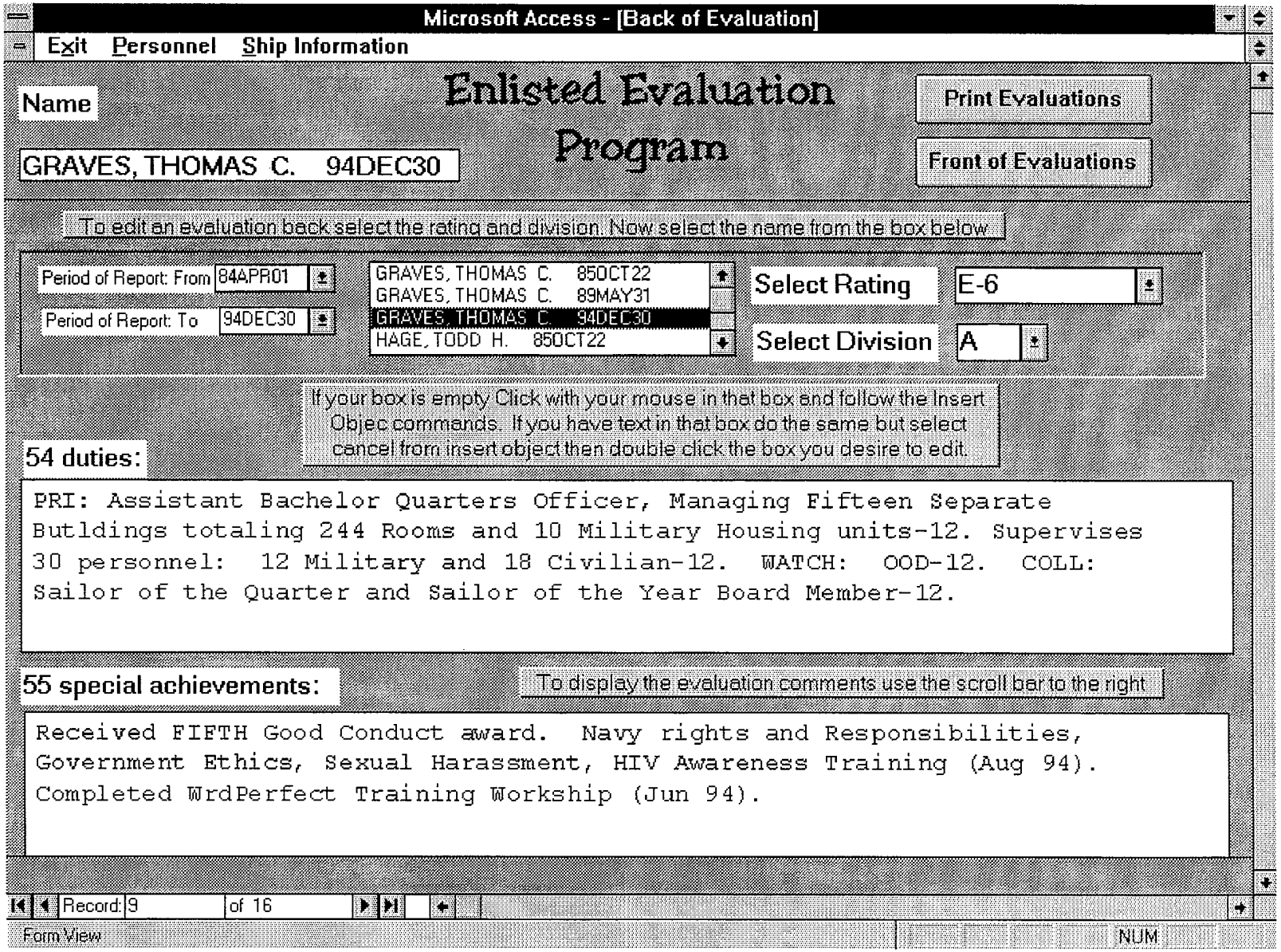

Figure 21: Back of Evaluation Screen

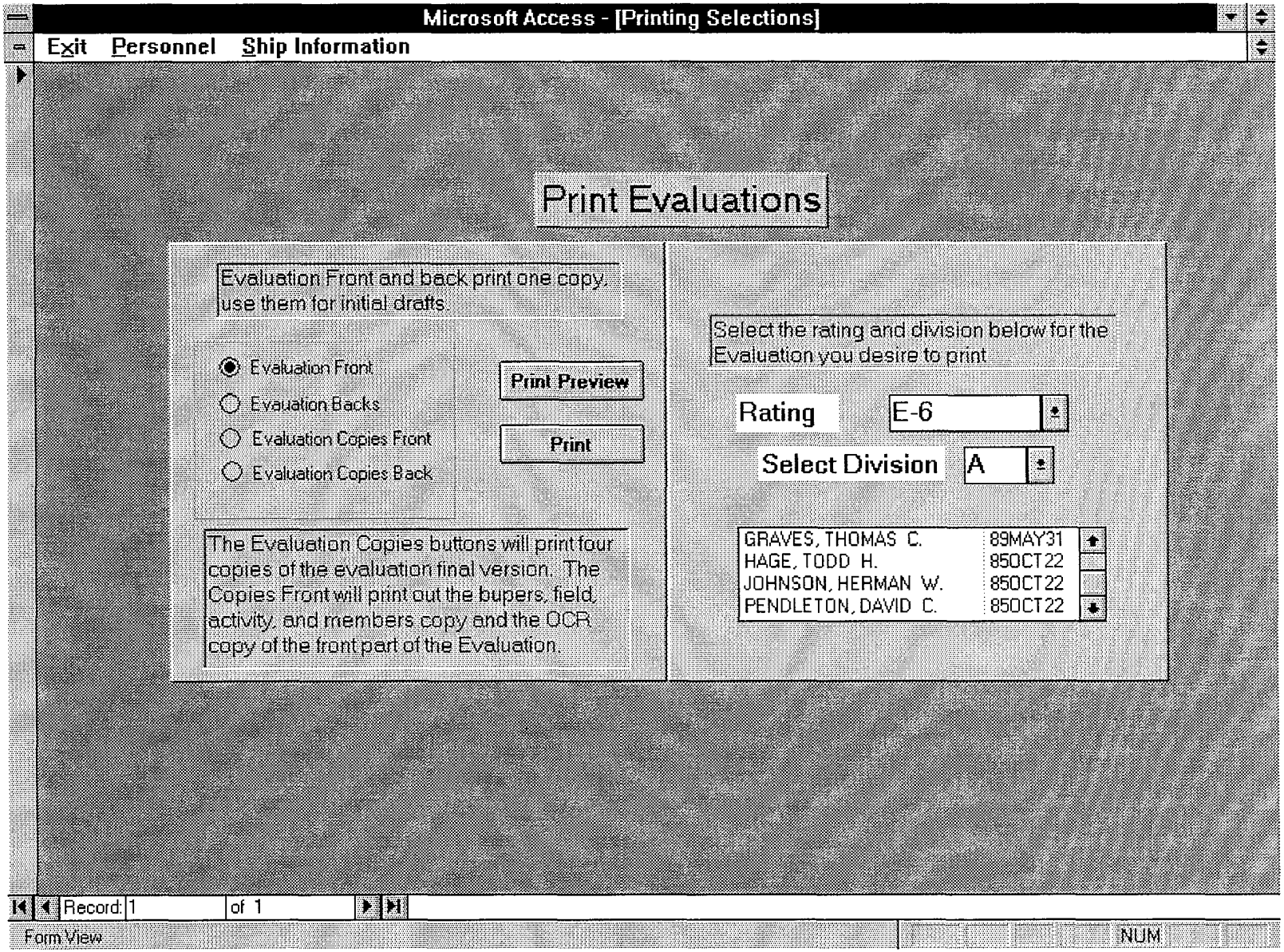

Figure 22: Print Evaluation Screen

D. PHASES AND METHODS NOT COVERED

The Development and Testing/Implementation phases of Mayhew were not covered to minimize the scope of the research. User Interface Prototyping and Prototype User Interface Test Plan were also not completed because the Enlisted Evaluation Program does not contain all the functionality required a fully developed prototype. The program is fully functional and is able to receive data and organize it for printing multiple evaluations but there is no help screen for the program. Ideally the program should be developed with Microsoft's developers tool-kit for Access. This would allow the program to run without having the software for Access installed on your computer. In addition, the program did not go through a usability test to reveal any major problems in the initial design. Final implementation was constricted to a few users only testing the core functionality of the program.

VI. DESIGN AND IMPLEMENTATION

A. DESIGN GOALS AND DEVELOPMENT

1. Design Goals

The design goals of this research was to prototype a windows based evaluation program for editing and printing enlisted evaluations. This prototype needed to conform with government standards in [Ref. 3] at the same time maintaining a consistency among screens to facilitate familiarity with the program and an easy to learn graphical user interface. The Enlisted Evaluation Program is developed in the Microsoft Windows environment using the developmental database software Access. Access was ideal to use as a rapid prototyping tool for this application because it allows developers to create windows based interfaces with a underlying relational database. Access' tools can create pull-down menus, radio buttons, colorful screens, and any mouse selectable option normally found in a windows environment.

2. Development Goals

The phases of development involved analysis of current windows programs, implementing desired functionalities, and the structure of the Enlisted Evaluation Program. Developing a program that produces an enlisted evaluation program was chosen for several reasons. The first of these reasons is no windows based evaluation program that uses a relational database and the second reason is the program has the ability to be expanded to support other administrative functions. The program was also chosen because it represents a finite goal; produce an enlisted evaluation in the proper format. The Enlisted Evaluation Program utilized data that is already entered in SNAP with very few exceptions. Because this information is present in SNAP including this type of functionality into NTCSSAM would not be as involved as other functionalities.

The implementation of the functionalities was centered around reducing the possibilities of error that a user could make and reducing the time required to create the

evaluation. Reducing errors from users can be accomplished in several ways and Access provided for this with several of its built in tools. Entry boxes can have a format assigned to each box. When users are asked to type in a crew members middle initial and they type the number seven the field in the box does not accept the entry. Entering dates into boxes is also controlled by formatting the field to prevent improper entry. All the date entrees require two numbers followed by three letters then two numbers to result in an entry similar to this: 90MAR30. The entry box will automatically make the letters capitalized as required in the evaluation form. Another Access tool that facilitates data entry and the reduction of errors is a pull down list. If there is a finite number of entries for a specific box having the user select form those will reduce the errors of typing and format. the front of the evaluation has several of these type of entry boxes. The entry box "Type of Report" only has three possible entries for that specific box; Concurrent, Special, Separation. Just by selecting one of these and not typing in the field prevents erroneous errors and saves time. Time spent by the user filling in boxes can also be save by using a radio button to fill in numerous fields with one selection. Frequently commands are required to give grades of "not observed" for all the areas being grades. Radio buttons that fill in all thirteen fields with not observes reduces entry time dramatically.

The development of the Enlisted Evaluation Program centered around the logical development of the screens and how data entry would be divided between them. The structure of the screens and the logical flow of navigating between screen is also a consideration for creating a program that is easy to use and learn. Each of the screens should be divided into logical groups of data entry and emulate the natural progression of constructing an evaluation in the same way you would without using a program. Creating a logical path for the construction of an evaluation enhances the use of the program and makes the program easier to learn. If the order of data input mirrors the way evaluations are normally constructed bye the user then creating an evaluation will be more intuitive.

B. IMPLEMENTATION OF DESIGN

1. Design of Enlisted Evaluation Program

Each of the screens developed have the same characteristics and the same backgrounds, headings, and pull-down menus where applicable. This includes the same color scheme, exit button, tool bar, and menu bar as well as other similarities. Familiarity among screens makes for smother navigation and friendlier environment [Ref. 10]. The specific design of the screens is divided into three areas of logical data entry; information about the command, crew information that does not change, information specific to a certain evaluation for that crew member. Command information is divided into three screens. One where users input information about the ship or station and the reporting seniors, another to input division names, and the third for evaluation summary information. Command information screens and some crew information does not change when creating a new evaluation, and in the case of command information this information can be used when creating any evaluation because it never changes for any crew member. For example the ships address is used in all evaluations. The evaluation front and back screens represent data specific to each evaluation for one crumblier. Crew members evaluations are identified by the crew members name and the date of the evaluation. A crew member will not change his name but different evaluations for that crew member need to be identified. The crew members name and date of report together separate the different evaluations for that one crew member. Selecting crew members for printing and editing are the same for three of the screens. Both the front and back evaluation screen and print screen have the identical display to select rating and division before selection the specific crew member. This duplication of format enhances familiarity with the program and how to display the desired information about a crew member. Command buttons are found frequently on screens and are used for navigation in the program and also used for action buttons for specific screens. The pull down menu on the top of the program screen will allow you to navigate to any screen in the program, but certain screens have command buttons that navigate to the next

logical screen when creating an evaluation. The evaluation front screen has two command buttons for navigation; "Edit Evaluation Back" and "Evaluations Print". These two buttons were added for logical navigation. It goes to reason that after you finish with the front of the evaluation you will want to work on the back, if not you may want to print out what you have worked on. All the screens have command buttons to exit which automatically saves all the work you have done before leaving the Enlisted Evaluation Program. Radio buttons were used in two instances in the program. The Front of Evaluations screen has two radio buttons to make all the grades four point zero or not observed. These are the most common entries for evaluations and these buttons automatically make selections for each of the thirteen graded categories of the evaluation. The print screen also used radio buttons to select between four different items. These buttons allow for different options of printing and preview for the front and back of evaluations both for the draft and final copies. Pull-down boxes were used in numerous places in the program. The pull-down boxes are used for entries with a finite lists of data that is allowed in the entry box. For information you type in like divisions on a ship or ratings there are only a finite number of divisions and nine ratings that are in the Navy, E-1 to E-9. Entry boxes that can only be filled with a finite number of entries are best served with pull down boxes because it reduces the amount of typing an minimizes errors. The list in Figure 15 on page 55 represents all the objects in the Enlisted Evaluation Program where a pull-down box is used to select and fill in the entry box with data.

Screen size is a limiting factor when determining the number of items that are included on one screen. Groups of data that can be organized in some logical part or that have a logical correlation should be placed on one screen. This grouping simulates starting with an idea then finishing with it before moving on to the next idea. Each one of the screens represent one idea and the items requiring data entry in that screen are part of that idea. For example the front of the evaluation screen fills in all the data that is required for the front of the evaluation. Users can look at the evaluation form and the evaluation screen and see all the items from one side of the evaluation form are present on the screen. The

naming of the boxes on the screen also correlate to the names of the boxes on the form to minimize any confusion about what information goes in what box. One of the more difficult design considerations was providing for the use of a text editor or a text editor capability while the Enlisted Evaluation Program was running. Exiting in and out of two programs to

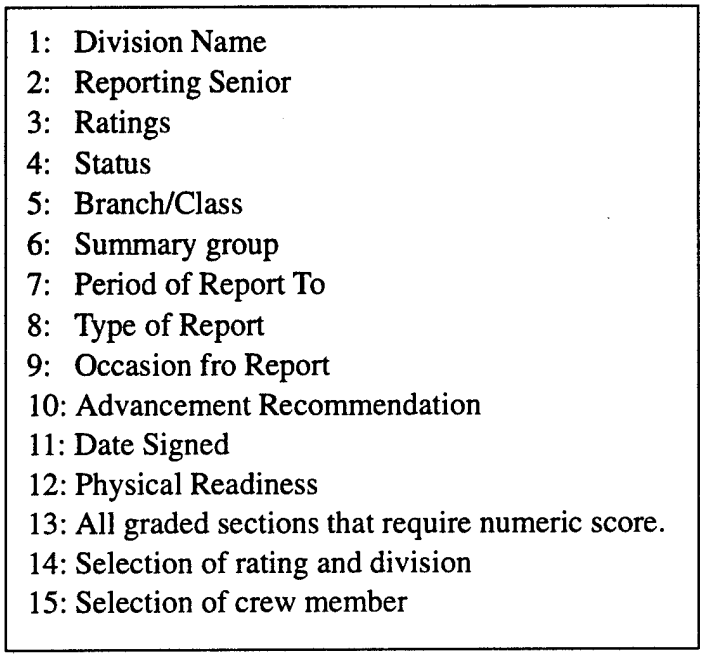

Figure 23: Evaluation Boxes with Pull-Down Menus

edit text then manage data in a database is unacceptable. Access works its way arround this problem through the use of Object Linking and Embedding 2.0. This allows the user to manipulate text inside the program and not switch in and out to edit text. Microsoft Word is word processing software that sports OLE 2.0 and enables the user to edit a document inside of the Enlisted Evaluation Program while you are in the program. Programs with the capability of OLE 2.0 will behave in the same manner. The screen size that is required to fit the text boxes on an evaluation exceeds the size of a typical 15" computer monitor whose resolution is set at 800X600 dots per inch. This limitation required the use of a scroll bar to access both the duties and comments box found on the back of the evaluation form.

VII. SUMMARY OF EVALUATION PROGRAM

A. FUNCTIONALITY NOT INCLUDED

The functionality limitations or omissions may or may not be related to the limitation of the software. Some of the functionalities were not explored as a result of the limitations of thesis work. The functionalities that were not included begin with moving from screen to screen. When users moved from the front of the evaluation screen to the back of the evaluation screen the crew member you were working on the front evaluation screen should show up when you switch to the back of the evaluation screen. Another involved Inserting text required too many mouse clicks and proved to be more awkward when using other software that was not made by Microsoft. Word Perfect text could not be imported into the document only text files from word perfect could be entered into an OLE program and then used. Selecting more than one name for printing would allow multiple evaluations to be printed with only one print command. The program should allow for printing the final version for all evaluations of a given group, like all E-6 evaluations. The evaluations should print the front and back of the evaluation at the same time so the user does not need to flip the paper on a double sided copy. The default fonts should be automatically set when you open a new duties or comments box.

B. DEVELOPMENT CONSTRAINTS

The most notable of the limitations is the specific requirements of security for evaluations. Access provides for security in a manner where you either have access to a screen or you do not. Access will not separate and prevent two division officers from accessing the evaluation information of the others division. You can prevent others from using the program at all but there is no provision for partial security using the same queries and screens. Separate software, The Access Developers Kit, is required to develop just a run time module so the inner workings of the program cannot be changes by a system administrator. The graphics for the front of the evaluation requires a large amount of

memory do display on the screen. System crashes occurred while operating in true color resolution. Not all the commands are written in the object oriented program language provided with Access. This is required for a portable system and runtime module to be developed. Command employment could not be entered as a separate entity and physically placed in the evaluation where it belongs. Command employment is placed at the end of duties and responsibilities and the size of both depend on their placement. Date blocks could have their format better controlled. The year part of the date blocks should limit the input to numbers over 90 and the day part of the date box should be limited to numbers under 31.

VIII. CONCLUSION

A. SUMMARY OF RESEARCH

The use of a specific design methodology or design tool will greatly enhance the user interface of NTCSSAM's functional development as well as the documentation required in user interface design. The survey forms are a good means of extracting data from users, senior management, and potential users but great care must be used in the questions that are generated. Interviews are another way to improve the design of NTCSSAM but the individuals conducting the interviews must be trained and experience at this task. It is not enough to be an expert user of the system to conduct interviews. The survey form in this research produced a number of functionalities from users but did not include inputs from senior officers or inspection teams. These are the groups that create the administrative requirements for the fleet and as such should be included in the process of design of NTCSSAM.

The Enlisted Evaluation Program provides an example of an evaluation program that can be included in NTCSSAM. The complexities of this program are rooted in the interface with a graphical text editor and printing out the required reports in a specific format. The screens give a good example of how to present the data and the thesis text indicate a core of the functionality required.

Using Microsoft Access 2.0 proved to be a good tool to develop a rapid prototype for an evaluation function. The Enlisted Evaluation Program was designed to provide the typical user with a more efficient way of creating and editing evaluations for service record entry. Access use of a relational database made the manipulation of data easier while the windows based presentation created a intuitive graphical interface for the user to create and print evaluations.

B. RECOMMENDATIONS

Before the current design method is followed a review of the current methodology should be conducted and compared with one of the methodologies listed in the previous chapters. NTCSSAM is designed to relieve the administrative burden of fleet personnel. To best provide this a few personnel could spend a few weeks doing a survey of shore and ship based personnel both officers and enlisted. Find out what would reduce their administrative burdens or rely on the officers interviewed in this thesis and concentrate on training and PQS. The requirements or functionality for any administrative program should not be completed without a detailed review of the documentation that requires the generation of these requirements in the fleet. Instructions which outline these requirements are:

- OPNAVINST 3541.1D (Shipboard Damage control Readiness)
- OPNAVINST 354.4D (Propulsion Examining Board for Conventionally Powered Ships)
- COMNAVSUFLANT/PAC 3540.1C (Engineering Department Organization Manual)
- OPNAVINST 3120.32D (U.S. Navy Standard Organization and Regulations Manual)

C. CONTINUED RESEARCH

There are many possibilities for continued research and developments related to this thesis. NAVMASSO is currently converting the functionalities of SNAP III and rewriting them in ADA to be incorporated into NTCSSAM. These functionalities or newer ones could be converted into ADA and demonstrated as a thesis.

A formal design method could be implemented to create NTCSSAM and a set of user interface screens developed using a rapid prototyping tool. these screens could be displayed to the fleet and tested using a formal design methodology.

The Enlisted Evaluation Program could be expanded in several was. functionality could be added to it incorporation other administrative requirements such as those listed in the survey form for NTCSSAM. The developers kit for Access could be used to convert the

Enlisted evaluation program and any other functionalities into a run time program. If a run time version of the program is created using the developers kit the development environment is not needed to run the program.

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